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Parton energy loss effect on Z+jet production in high-energy nuclear collisions

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Gauge boson tagged jet production has long be regarded as a "golden channel" to study the jet quenching effect. Recently, the back-to-back azimuthal alignment $\Delta\phi_{jZ}$, p_T asymmetry x_{jZ} distribution and its mean value, as well as the average number of jet partners per Z boson R_{jZ} of Z associated jet production have been reported in both pp and Pb-Pb collisions by CMS.

In the talk, we report the theoretical calculations of Z/W+jet production in pp and Pb-Pb at the LHC, which are confronted with all available data and very nice agreements between theory and data are observed for all four observables of Z+jet in both pp and Pb-Pb collisions. In the model, a very good description of Z+jet in pp is achieved by utilizing Sherpa, which combines the NLO with resummation by a matched parton shower (PS). To compute observables of Z+jet in Pb-Pb we consider the parton energy loss in hot/dense QCD medium, which is simulated by Linear Boltzmann Transport(LBT) model.

Our calculations of distributions of R_{jZ} can give excellent descriptions of CMS measurements both in pp and Pb-Pb. Compared to pp collisions, R_{jZ} is suppressed because large fraction of jet loss energy and fall below transverse momentum threshold in Pb-Pb collisions. We evaluate the transverse momentum imbalance x_{jZ} simultaneously which is broadened and shifted to lower value due to jet jet quenching, and we find a very good agreement with LHC data for both x_{jZ} distribution and its mean value as well as the relative shift between pp and Pb+Pb collisions.

The distribution of $\Delta\phi_{jZ}$ at large azimuthal angle in Pb-Pb is moderately suppressed relative to that in pp, and it is the suppression of multi-jets lead to the modification of Z+jet azimuthal angle correlations.

To investigate in more detail where the energy is gone and how the energy is transported inside and outside the jet-cone, we also calculate the modification of the substructure and energy flow of Z boson tagged jet. The energy flow within the jet is modified by shifting the momentum away from the jet axis out to large relative angular distances.

Summary

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